# Cherenkov Counter Update #3

Karl Kaess, Jason St. John

LArIAT Weekly Meeting

22 August 2013

# Cosmics

With PMT installed in Cherenkov head, and scintillator paddles at front and back vacuum windows, we observed triple coincidence signals at a rate of  1 per hour. (Many thanks to Eva for the loaned oscilloscope, which made everything possible.)

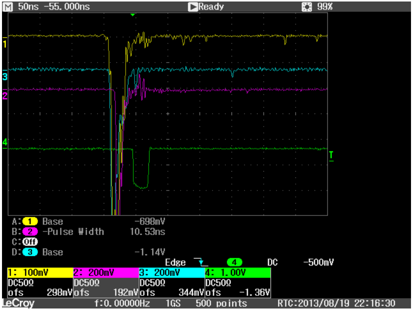


Figure 1: Oscilloscope output – Ch. 1: Front Scintillator, Ch. 2: Cerenkov PMT, Ch. 3: Rear Scintillator, Ch. 4: Triple-coincidence NIM logic (Ch. 1-3: 10x amplification)

During our final 16-hour run, we saw:

- 692 Two-scintillator coincidences (7 expected accidentals)
- 13 triple coincidences (0.01 expected accidentals)

# Cosmics - Remaining Questions

- Are we seeing air showers? We could (in order of decreasing effort):
  - Add a veto paddle
  - Take data with paddles reconfigured to minimize triple-coincidence solid angle
  - Wait for Test Test Beam
- Are we seeing scintillation instead of Cerenkov light?

# Test Test Beam

The main challenge prior to running at MTest is improving data collection. In order to fully benefit from the Test Test Beam we must:

- Have a method for storing event data.
- Have a way to correlate those data with other data generated during the run. (There are ways, I'm sure, but I'm new!)


Figure 2: Current electronics rack. It's not much, but in case you're bored and want to look at pictures... or read their captions...

# Backup

# Backup

Calculation of expected accidentals for 16-hour run:

- Ch. 1 - Signal Frequency: 40Hz, Avg. Pulse Width: 50ns
- Ch. 2 - Signal Frequency: 180Hz, Avg. Pulse Width: 43ns
- Ch. 3 - Signal Frequency: 31Hz, Avg. Pulse Width: 47 ns

Ch.1-Ch.3 accidentals:
$40Hz * 31Hz * (50 + 47)x10^{-9}s * (16 * 60 * 60)s = 7$

Similar calculation performed for triple-coincidence accidentals, but with measured (higher) two-scintillator coincidence frequency.

# Backup

Derivation of physics used on Update 2 (will move slide to that document eventually)

Definition of $p_{crit}$:

- $v = \frac{cp}{\sqrt{c^2 {m_0}^2 + p^2}} > c/n \implies p > \frac{m_0 c}{\sqrt{n^2 - 1}} = p_{crit}$

Demonstration of M and P dependence for $p_{crit}$, from $n - 1 \propto M, P$ for non-polar gasses:

- $n^2 - 1 = ((n-1)+1)^2 - 1 = 2(n-1) + (n-1)^2 \approx 2(n-1) \implies p_{crit} \tilde{\propto} \frac{1}{\sqrt{M}}, \frac{1}{\sqrt{P}}$